Available online at www.sciencedirect.com
SciVerse ScienceDirect
Advances in Space Research 50 (2012) 1564–1569
ADVANCES IN SPACE RESEARCH (a COSPAR publication)
www.elsevier.com/locate/asr

Analysis of data of "Clementine" and "KAGUYA" missions and "ULCN" and "KSC-1162" catalogues

Y.A. Nefedyev [a,*], S.G. Valeev [b], R.R. Mikeev [b], A.O. Andreev [a], N.Y. Varaksina [a]

[a] Engelhardt Astronomical Observatory, Kazan Federal University, Tatarstan, Zelenodolsk 422526, St. Observatory, EAO, Russia
[b] Ulyanovsk Technological State University, Ulyanovsk 432027, St. Severny Venec, 32, Russia

Received 18 December 2011; received in revised form 11 July 2012; accepted 12 July 2012
Available online 20 July 2012

Abstract

In this paper an analysis of data coordinate systems from selenographic catalogues and space missions was carried out. The lunar macrorelief models were made on basis of the software package ASNI USTU using method of the spherical harmonic expansion. These models accurately describe the global features of the lunar figure. To construct these models the following sources of topographic information were used: "Clementine" and "KAGUYA" (Selena, Japan mission) missions, "KSC-1162" (Kazan selenocentric catalogue), "Kiev" (selenodesic catalogue), "SAI" (Chuikova (1975)), "Bills, Ferrari", "ULCN" (The Unified Lunar Control Network 2005). Direct comparison hypsometric information "KSC-1162" catalogue data with "Clementine" mission was carried out. These researches confirmed a good agreement of the hypsometric information of compared systems. The normalized coefficients were obtained on basis of the hypsometric information expansion for eight sources. The displacement of the lunar center of mass (LCM) relatively to the lunar center of figure (LCF) was obtained by using topographic data selenodetical catalogues and space missions.

Keywords: Selenodesy; Center masses; Center figure; Robust methods; Cosmic missions; Selenocentric catalogues

1. Introduction

At the present time all data for the lunar topography can be divided into two types. On the one hand, first data type obtained by the lunar surface laser scanning from onboard satellites describes the lunar relief well but it does not give the coordinates of reference objects on the Moon. Other data types obtained on the basis of directly binding lunar objects to the stars give the exact coordinates of reference objects but they do not describe with sufficient accuracy the lunar relief. And all of these systems have a different frame of reference and orientation of the axes. It is well known that data obtained from all the space missions relates to a quasi-dynamic frame of reference in which the center of origin is the LCM, but their axes do not coincide with the axes of inertia of the Moon.

Most modern selenodetical catalogues have a quasi-dynamic system of coordinates too. Either they have a center of origin of coordinates that does not coincide with the LCM or the axes do not coincide with the axes of inertia of the Moon. At present it should also be noted that there is no reference dynamic selenocentric coordinate system covering enough area on the lunar surface based on satellite observations.

In addition despite the accuracy of the lunar physical relief obtained by space missions the reference surface of this relief has a rather vague figure. Therefore in most articles describing satellite topographic data much attention is paid to the high accuracy of the obtained physical relief and the question of the surface reference is glossed over. So far there is no method for constructing the lunar photogrammetric topographic satellite map based on the integration of the thousands separate pictures of the lunar

* Corresponding author. Tel.: +7 9274259330; fax: +7 8432927797.
E-mail addresses: Yura.Nefedyev@gmail.com (Y.A. Nefedyev), sgv@ulstu.ru (S.G. Valeev), AMEEKEY@gmail.com (R.R. Mikeev), alexey-andreev93@mail.ru (A.O. Andreev), vnu_357@mail.ru (N.Y. Varaksina).

0273-1177/$36.00 © 2012 COSPAR. Published by Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.asr.2012.07.012